SUPPLEMENT TO THE REVISED
FINAL CORRECTIVE MEASURES STUDY
RMI TITANIUM CO. - SODIUM PLANT
ASHTABULA, OHIO

OHD 000 810 242

Prepared for:

RMI Titanium Company
Niles, Ohio

Prepared by:

Brown and Caldwell
(Formerly ECKENFELDER INC.®)
227 French Landing Drive
Nashville, Tennessee 37228
(615) 255-2288

66497.005

RMI TITANIUM Company

P.O. BOX 269
1000 WARREN AVENUE
NILES, OHIO 44446-0269

11 January 1999

Mr. Thomas W. Matheson
Mail Code HRP - 8J
U.S. EPA, Region 5
77 West Jackson Boulevard
Chicago. IL 60604 - 3590

Re: RMI Titanium Company Sodium Plant
OHD 000 - 810 - 242

Dear Mr. Matheson:

As we have discussed, subsequent to the submission of the Revised Final Corrective Measures Study for the RMI Titanium Company Sodium Plant in May 1995, a portion of the Sodium Plant property was selected as the site for a new landfill to be constructed as part of the Fields Brook Superfund Site remediation. The construction of a landfill at RMI provides new potentially feasible corrective measures alternatives for disposal of soils in the on-site solid waste management units. Enclosed is a supplement to the CMS that evaluates the new alternatives, and recommends new alternative 4F - disposal of contaminated soil in areas B, C, and G in the new landfill, prepared on our behalf by Eckenfelder/Brown and Caldwell.

We will be glad to meet with you, at your office or at the Sodium Plant, to present and discuss these new alternatives. Should you have any questions, or to arrange a meeting, please contact me.

Sincerely,

Richard L. Mason
Director
Environmental Affairs
Phone: 330/544-7688
FAX: 330/544-1029

c w/enc: A. La Favre, Ohio EPA
D. Korb, RMI
J. Gorman, RMI
J. Pintenich, Eckenfelder/Brown and Caldwell

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUPPLEMENT TO THE
REVISED FINAL CORRECTIVE MEASURES STUDY
RMI TITANIUM CO. - SODIUM PLANT
ASHTABULA, OHIO
OHD 000 810 242

INTRODUCTION

This document serves as a supplement to the Revised Final Corrective Measures Study (CMS) for the RMI Titanium Company (RMI) Sodium Plant located in Ashtabula, Ohio. The Revised Final CMS was submitted to the United States Environmental Protection Agency (USEPA), Region 5 in May 1995. RMI has been named as a potentially responsible party (PRP) in the Fields Brook Superfund Site, also located in Ashtabula, Ohio. Subsequent to the submission of the Revised Final CMS, RMI and other PRPs entered into an agreement with USEPA Region 5 whereby an engineered landfill will be constructed on the RMI Sodium Plant property as part of the proposed remedy for the Fields Brook Superfund Site. The construction of an engineered landfill on the RMI Sodium Plant property provides new, potentially feasible, corrective measures alternatives for disposal of certain on-site soils in solid waste management units (SWMUs) on the property. This supplement has been prepared to evaluate the new alternatives as compared to the previously recommended alternative set forth in the Revised Final CMS.

Because this document supplements the Revised Final CMS, most of the information presented in the CMS is also appropriate for the new proposed alternatives and, therefore, has not been reproduced here. This information includes that presented in Sections 1.0 to 4.0 and 5.1. In particular, none of the conclusions or recommendations of the various facility investigations have changed; the scope of the CMS has not changed; the results of the Health and Environmental Assessment (HEA) remain unchanged; the corrective action objectives are the same; and the results of the preliminary identification, screening, and selection of technologies are the same. As such, this supplement includes:

- A description of the new corrective measures alternatives and detailed analyses of the alternatives (i.e., similar to Sections 5.2 to 5.6 of the CMS).

- A comparison of the new alternatives to the previously recommended alternative described in the Revised Final CMS (i.e., similar to Section 6.0 of the CMS).

- The schedule for implementation of the selected corrective measures alternative (i.e., Section 7.0 of the CMS).

DETAILED ANALYSIS OF CORRECTIVE MEASURE ALTERNATIVES

Evaluation Criteria

A detailed evaluation of alternatives must be conducted in accordance with the requirements for Corrective Action Plans, as detailed in the project Scope of Work issued by the USEPA and the "Corrective Measures Study Plan", as well as the guidance provided by the "RCRA Corrective Action Plan (Interim Final)".

As stated previously, the engineered landfill proposed as part of the Fields Brook Superfund Site remedy provides new alternatives for disposal of on-site soil at the RMI facility. The new alternatives presented in this supplement are identified as:

- Alternative 4F - Excavation of Areas B, C, and G; Temporary Stockpiling of Area B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F

- Alternative 4G – Excavation of Areas B, C, and G; Temporary Stockpiling Area B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F; Capping of Area A

Alternatives 4A through 4E, dealing with excavation of site soils and on-site disposal, were previously evaluated in the Revised Final CMS.

The purpose of this section is to perform a detailed analysis of the new alternatives as required by Task II of the Scope of Work, taking into account site-specific conditions. The detailed analysis includes a description of how the alternatives will be implemented for the specific site area and an evaluation of the alternatives using specific evaluation criteria. The new alternatives have been carried forward for a comparative evaluation with the recommended alternative identified previously in the Revised Final CMS. Based upon the findings of the comparative analysis, a corrective measures recommendation will be made.

The criteria utilized to evaluate the alternatives, as required by Task II, are as follows:

- Technical
- Environmental
- Human Health
- Institutional

In addition, a cost estimate has been developed for the alternatives.

A detailed discussion of the evaluation criteria is presented in the Revised Final CMS and, therefore, is not repeated in this supplement.

Alternative 4F - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal at New Engineered Landfill; No Further Action at Areas D and F

Alternative Description. This alternative consists of the excavation of Areas B, C, and G; transport and temporary stockpiling of the Area B and C excavated soil at a location west of Area A; and disposal in an on-site engineered landfill located in the vicinity of Areas B and C (see Figure 1). The proposed landfill will consist of the following elements per the Record of Decision (ROD) for the Fields Brook Superfund Site Operable Unit #4:

Bottom liner (from bottom to top):

- 6 inch compacted in-situ clay; the bottom of the clay shall be at least 5 feet above the historical high ground water table
- 60-mil secondary geomembrane liner
- 6 inch sand/gravel leachate detection layer
- 60-mil primary geomembrane liner
- 6 inch sand/gravel layer with a leachate collection system

Cover (from bottom to top):

- 12 inch soil/gravel with a gas venting layer
- 40-mil geomembrane liner
- drainage geocomposite
- 24 inches of clean cover soil and 6 inches of topsoil capable of supporting native vegetative growth

Groundwater monitoring wells will also be included as part of the landfill system. Additional details for the landfill will be included in the Fields Brook Superfund Site Remedial Design, which will be approved by USEPA, Region 5 prior to implementation.

After construction of the landfill, the excavated soil from Areas B, C, and G will be transported and placed into the landfill. Material from Areas B and C will be temporarily stockpiled during construction of the new landfill. Impacted soil and sediment excavated from the Fields Brook Superfund Site will also be placed into the landfill. As part of the Fields Brook design, area surface water drainage patterns will be modified to control stormwater.

This alternative includes No Further Action at Areas D and F. The existing cover on Area A will be maintained under current operating and maintenance (O&M) procedures. The use of Areas A, B, and C will be restricted in the appropriate property deeds.

Post-closure for the new landfill will include maintaining the integrity and effectiveness of the cap (i.e., establishing an O&M program to correct the effects of settling, subsidence, and preventing run-on and run-off from eroding or otherwise damaging the cap), developing a groundwater monitoring system that can detect the presence and off-site migration of constituents of concern, and maintaining and protecting survey bench marks. These considerations are also applicable to Area A.

Excavation activities will involve surficial (0.5 feet) excavation in Areas B and C, while Area G will be excavated to a depth of 3.5 feet. The total volume of material to be excavated and transported is anticipated to be approximately 7,850 cubic yards. A summary of all excavation volumes and their development was previously provided in Table 4-6 and related text of the Revised Final CMS. Excavated material will be placed into the new engineered landfill. Area G will be subsequently filled to within 6 inches of surrounding grade with clean backfill. The remaining 6 inches will be filled with topsoil, vegetated, and maintained as required. The active excavation and backfill area will be protected from erosion with hay bales, silt fence, or other effective erosion and sediment control barriers until proper vegetation has been established. Area G will be revegetated using a seed variety commercially available in the Ashtabula area.

Excavation of the ditch sediment along the eastern side of Areas B and C will be addressed as part of construction of the new landfill. Measures will be required to prevent erosion of sediment. New drainage ditches will be constructed and flow in the ditch rerouted prior to excavation in the ditch. The excavated sediment will be dewatered prior to placement into the landfill.

Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and disposal in an engineered landfill are safe, effective, and reliable alternatives. With proper maintenance, the useful life of this alternative is expected to be indefinite. Infiltration and percolation of incident precipitation and stormwater resulting in potential constituent migration will be virtually eliminated for all site areas except Areas D and F. However, the RFI and HEA have indicated that the site constituents are relatively immobile. The affected soil at Area D is located at a depth range of 3.0 feet to 6.5 feet below ground surface; thus, the top 3 feet act as an effective cover preventing direct contact and preventing constituent migration due to erosion. In addition, the HEA concluded that constituent concentrations in soil associated with Areas D and F (as well as all of the other SWMUs) did not pose a significant risk.

Implementation of this alternative will remove affected surficial soils (except in Area F) and sediment, thereby eliminating the potential for direct contact, the potential for constituent transport in the sediment and water in the drainage ditch, and the potential for transport of site constituents via erosion and surface runoff. In addition, the potential for future groundwater contamination is significantly reduced by excavation, consolidation, and isolation of the waste sources. Operation and maintenance requirements are not sufficiently different from the existing facility site maintenance plan, with the exception of the addition of periodic cap inspections and groundwater monitoring.

Implementability is not anticipated to be difficult due to the shallow soil/sediment depths requiring excavation, the existence of an engineered landfill for on-site placement of excavated material, and readily available haul roads which are easily maintained. As discussed in the Revised Final CMS, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities.

Environmental Evaluation. Excavation and subsequent backfill and revegetation sufficiently achieves all environmental objectives at Areas B, C, and G. Removal of constituent sources at Areas B, C, and G effectively eliminates all environmental concerns due to the removal of the constituent material from the area. On-site disposal in an engineered landfill virtually eliminates potential constituent migration pathways in the environment by consolidating the affected soil and sediment and isolating the material in an engineered landfill and protecting the upper cap with a soil and vegetative cover. Because the affected soils at Area D are located approximately 3 feet below ground surface, the measured levels in Areas D and F are only slightly above the USEPA action level, and the baseline risk assessment shows that all estimated risks for Areas D and F are within USEPA acceptable limits, no action at Areas D and F, in conjunction with excavation and disposal at other site areas, sufficiently addresses environmental criteria. There are no obvious adverse effects to this alternative.

Human Health Evaluation. The combined excavation/on-site disposal alternative eliminates all identified short- and long-term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via erosive forces (erosion and sediment controls will also be implemented for the temporary stockpile area during landfill construction), and reducing the potential for constituent migration due to incident precipitation.

Short-term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil erosion control plan approval, neither of which are anticipated to be a problem at this site.

Cost Evaluation. The cost estimate includes the anticipated capital expenditures and the O&M costs associated with the alternative. It is assumed that the construction costs for the new engineered landfill will be shared by members of the Fields Brook Superfund Site PRP group. Therefore, the construction costs for the landfill included in this estimate are based on the percentage of Area B, C, and G soils to the total planned landfill volume. The long-term O&M costs of the landfill, including groundwater monitoring, have been estimated based upon costs summarized in the Fields Brook ROD for OU No. 4, and have been included herein. Capital costs include, as applicable, direct and indirect capital costs. Direct capital costs include excavation, equipment, and landfill construction; while indirect capital costs are associated with items such as land cost, engineering and legal fees, licensing and permit fees, start up and shake down costs, as well as contingency allowances. Operation and maintenance costs typically include those post-construction costs which are associated with the short and/or long-term O&M of the alternative, associated materials and labor costs, as well as energy requirements of the alternative. Operation and maintenance expenditures may also include, on a case by case basis, items such as purchased services, periodic disposal and treatment costs, monitoring costs, administrative costs, insurance, and taxes. The capital and O&M cost estimate is provided in 1993 costs in order to compare to the Revised Final CMS cost estimates.

Capital and annual O&M costs for the excavation, fill, transportation, landfill construction, and long-term monitoring are estimated to be $3,100,000 and $130,000, respectively.

Alternative 4G - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F; Capping of Area A

This alternative consists of the same components as described above for Alternative 4F with the exception of additional measures for Area A. Alternative 4G includes the placement of a geosynthetic cap over Area A. Placement of a cap on Area A was also discussed in the Revised Final CMS (see Alternative 4A). Components of the capping system for Area A include a graded and compacted base material (i.e., the existing cover material) adequately prepared to accept a geomembrane, which will be overlain by a synthetic drainage layer, all of which is overlain and protected by a minimum of 3.5 feet of clean fill and 0.5 feet of topsoil that will sustain vegetative growth. Area A will then be revegetated using a seed variety commercially available in the Ashtabula area. This capping system meets the intent of RCRA guidance documents for hazardous waste landfill caps. Additionally, this design is equivalent to requirements set forth by Ohio Administrative Code 3745-27-11. No wastes associated with Area A are anticipated to be disturbed. In addition, the DNAPL existing beneath Area A (off-site source) is not expected to be impacted by these corrective measures.

Alternative 4G will be identical to Alternative 4F above relative to the technical, environmental, human health, and institutional evaluation criteria. The use of Areas A, B, C, and the new landfill will be restricted in the property deed.

Cost Evaluation. The cost estimate includes the anticipated capital expenditures and the O&M costs associated with the alternative. The costs for this alternative are identical to those for Alternative 4F above with the addition of capping costs for Area A. Costs for geosynthetic capping of Area A were obtained from Alternative 4A of the Revised Final CMS, but were revised since Alternative 4A only considered capping one-half of Area A. The capital and O&M cost estimate is provided in 1993 costs in order to compare to the Revised Final CMS cost estimates.

Capital and O&M costs for the excavation, fill, transportation, landfill construction, geosynthetic capping of Area A, and long-term monitoring are estimated to be $3,900,000 and $132,000, respectively.

COMPARATIVE ANALYSIS OF THE SUPPLEMENTAL ALTERNATIVES TO THE RECOMMENDED ALTERNATIVE FROM THE REVISED FINAL CMS

This section compares Alternative 4F and Alternative 4G to the previously recommended alternative from the Revised Final CMS (Alternative 4E). Based on this comparative analysis, a corrective measure alternative is recommended for implementation, as required by Task III of the USEPA Scope of Work. The descriptions of the compared alternatives are as follows:

4E - Excavation of Areas B, C, and G; Disposal at Area A; No Further Action at Areas D and F.

4F - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F.

4G - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F; Capping of Area A

A summary of the detailed evaluation performed for Alternatives 4F and 4G, presented herein, and for Alternative 4E, presented in the Revised Final CMS, is provided in Table 1. This table summarizes evaluation criteria and findings for the three alternatives.

The following evaluation criteria have been used to comparatively evaluate the three alternatives:

- Long-term reliability and effectiveness
- Reduction of mobility, toxicity, or volume of waste
- Short-term effectiveness
- Implementability
- Cost

These criteria are used to highlight the beneficial and adverse tradeoffs associated with one alternative over another. These alternatives were evaluated based upon site-specific considerations and the extent to which they address USEPA action levels. The comparative analysis of alternatives is summarized in Table 2 and is described below.

Long-Term Reliability and Effectiveness

Long-term reliability and effectiveness are utilized to evaluate the appropriateness of an alternative based upon its ability to achieve intended functions, such as meeting media cleanup standards in the short term, while not creating greater or future risks which may necessitate future corrective action. This factor also considers the complexity of the O&M and the potential effect of failure.

Alternatives 4E, 4F, and 4G exhibit exceptional long-term reliability and effectiveness because the direct exposure pathways for human and environmental contact are eliminated by removal and consolidation of the affected material. The components of these three alternatives are very similar and differ primarily in the final disposition of the excavated material (i.e., Area A vs. a new landfill). As such, Alternatives 4F and 4G provide somewhat greater long-term reliability because the excavated material will be placed into an engineered landfill with a bottom liner and cover system, which will also be equipped with leachate collection and detection systems and a gas venting system.

Reduction of Mobility, Toxicity, or Volume of Waste

Reduction in mobility, toxicity, or volume is particularly valuable in circumstances in which the constituents of interest may degrade into more hazardous or toxic products or fail to attenuate naturally. However, toxicity reduction is not an appropriate consideration for this facility because the constituents present in the affected material are not at toxic levels. Mobility is addressed by placing the affected material into an engineered landfill, while volume is addressed by consolidation of the material. Alternatives 4E, 4F, and 4G equally satisfy the volume and reduction of mobility criteria.

Short-Term Effectiveness

Short-term effectiveness is concerned with the ability of the assembled alternative to be protective of human health and the environment during the short term, while also reducing long-term risks. Because the potential risk to human health and the environment has been shown to not be a concern, short-term effectiveness is suitably addressed by each of the alternatives. All three alternatives demonstrate relatively similar and acceptable short-term effectiveness.

Implementability

Implementability is primarily concerned with the ease of construction and operation, including any requirements for innovative construction techniques or materials. Time required to achieve a given level of response is also considered and includes two components - implementation time and time required to see beneficial results.

Because the technologies are proven and easily implemented, implementability is relatively comparable. The relative timing of each alternative is anticipated to be generally within a nine month time period. In general, all three alternatives are easily and readily implementable with standard materials, construction techniques and equipment, and transportation equipment. Alternatives 4F and 4G would require somewhat longer implementation time than 4E due to construction of a new engineered landfill. However, this additional time is expected to be minimal.

Cost

Although cost is not typically considered to be a predominant criterion for selection of an alternative over the protection of health and the environment, cost benefit is considered to be an important factor in the selection of the proposed alternative for the RMI facility since protection of human health and the environment has been determined during the HEA (Section 2) to not be a concern. Cost estimates include both capital and O&M costs. Capital cost estimates have addressed both direct and indirect costs, while O&M cost estimates include both labor, material, and services costs. Comparative capital, O&M, and present worth values of the three alternatives are summarized in Table 3.

For comparable environmental benefit, the Alternative 4E disposal costs are lower than the anticipated costs for Alternatives 4F and 4G. However, due primarily to the fact that RMI has already agreed to place an engineered landfill on their site using funds from the Fields Brook Superfund Site PRP Group, Alternative 4F is preferred. The primary value of this alternative is attributable to the fact that on-site disposal takes place in an engineered landfill which will be located on-site and, therefore, preparation and revegetation of Area A does not factor into the overall capital cost of the remedy.

DESCRIPTION OF THE RECOMMENDED ALTERNATIVE

The individual and comparative evaluations of the assembled alternatives have resulted in the recommendation of Alternative 4F as the corrective measure alternative for the RMI Sodium facility. This selection has been based upon the evaluation criteria of technical factors, environmental effects, human exposure, and institutional considerations and the comparative criteria of long-term reliability and effectiveness; reduction of mobility, toxicity, or volume of waste; short-term effectiveness; implementability; and cost.

The soil and sediment to be excavated and placed in the new engineered landfill have been shown to be nonhazardous and are being addressed because USEPA-established action levels for soil (and, indirectly, surface water) have been exceeded for some inorganic constituents. Area A was previously closed in 1981 in accordance with approval from the Ohio EPA. In addition, the Baseline Risk Assessment showed that the existing site conditions do not result in risks of concern outside an industrial setting. As such, the additional benefit observed by construction of a cover system on Area A is not significantly improved over that of the existing soil cover system, especially considering the cost difference. The additional cost associated with a geomembrane system on Area A is not warranted for this site, and the recommended alternative includes no further action at Area A.

The specific site areas addressed by this alternative (shown in Figure 2) have been determined based upon existing historical data as well as physical structures (i.e., buildings, roads, and ditches) and, in many cases, were extended 5 to 20 feet to provide additional assurance that waste material of concern is being addressed. In particular, this approach has been applied to Area G where a large portion of the waste material is to be removed. These boundaries represent the maximum lateral extent of remedial action; maximum excavation depths have been determined by increasing the associated action level depth, to the next highest 0.5 foot increment, where appropriate. Risk calculations were performed for "residual" constituent concentrations in soil at the various SWMUs (see Appendix E of the Revised Final CMS). Generally, the residual risks are comparable to those calculated in the baseline risk assessment and to background. None of the carcinogenic risks for the current or future scenario exceeded USEPA's lower acceptable limit (1 x 10-4), nor did any hazard index exceed USEPA's acceptable limit of 1.0.

With the approach to establishing area boundaries described above, the low constituent concentrations detected in the soil at all of the SWMUs (see Section 6 of the RFI), and the results of the risk calculations for residual soil, additional investigatory or confirmatory sampling efforts are not anticipated to be needed for the successful implementation of this corrective measure alternative.

Alternative 4F consists of the surficial (approximately 0.5 feet) excavation of affected soil in Areas B and C, while soil in Area G is excavated to 3.5 feet. Approximately 100 cubic yards of sediment from the drainage ditch segment immediately east of Area B will also be excavated and dewatered prior to disposal. This volume represents an approximate depth of 6 inches over a length of approximately 200 feet. This activity will be performed as part of the landfill construction and will be preceded by the implementation of surface water controls to eliminate the potential for downstream migration of constituents in the sediment. Erosion control and soil conservation measures for stockpiled materials or any working area will be implemented as necessary to prevent constituent transport or run-on/runoff.

Excavated material from Areas B and C and the ditch will be placed in a temporary stockpile during construction of the new landfill. This stockpile area is tentatively located west of Area A. Once construction of the new landfill is complete, the excavated material (estimated to be 7,850 cubic yards) will be transported and placed into the new landfill, where it will be spread uniformly and compacted. Area G will be first backfilled to within 6 inches; then revegetation of Areas B, C, and G will require a 6 inch layer of topsoil to bring them up to grade, followed by seeding, fertilizing, and mulching of all areas. Construction requirements and design details for the new engineered landfill will be subject to USEPA approval and addressed under the Remedial Design for the Fields Brook Superfund Site.

Operation and maintenance requirements for Areas B and C will be addressed by O&M of the new landfill and will include routine inspection, watering, revegetation, and mowing of the vegetative cover; prohibiting woody vegetative growth; and any general repair to the cover system associated with abnormal settlement, heavy seasonal rainfall events, freeze/thaw events, or burrowing animals. Existing and proposed new groundwater monitoring wells will be utilized to monitor the effectiveness of the corrective measure. Wells will be monitored semiannually for a period of three years. The wells will be sampled and analyzed for a focused parameter list (e.g., pH, TSS, Ba, and Cd). At the end of the three year period, the data will be statistically evaluated to determine whether or not continued monitoring is required based on consistent or decreasing constituent concentrations. If monitoring is required for more than the initial three years, the data will be reevaluated. This will continue until results indicate that monitoring is no longer required. No monitoring of the unsaturated zone and no run-on or run-off monitoring are necessary. Site security is expected to include six-foot chain link fencing and periodic inspections. Notices will be placed in the deeds to the properties which will place restrictions on the future use of Area A and the new landfill.

For implementation of this recommended corrective measure, as was the case for all of the alternatives in the Revised Final CMS, RMI proposes designation of a single land-based Corrective Action Management Unit (CAMU). This proposed designation is required to be approved by the USEPA and Ohio EPA, at which time it will then be incorporated into the RMI Sodium Plant RCRA permit. The boundaries of the proposed CAMU are shown on Figure 2. Selection of the boundaries for the proposed CAMU is based on the results of the RFI, the results of the evaluation of potential corrective measures performed in the Revised Final CMS, and the requirements for CAMUs set forth in 40 CFR 264.552. As specified at 40 CFR 264.552(a), placement of remediation wastes into or within this CAMU will not constitute land disposal of hazardous waste, and consolidation of wastes within this CAMU will not require RMI to meet all minimum technology requirements.

Consideration has been given to the requirements of 40 CFR 264.552(c) in proposing this CAMU. These requirements and the manner in which RMI proposes to meet them are summarized in Table 4. In general, the recommended alternative includes excavation and on site disposal; no treatment is anticipated and temporary units will not be utilized. The recommended alternative is a reliable, effective, protective, and cost-effective remedy. Excavation and on-site disposal is a proven reliable technology. Based on the results of the HEA and the Baseline Risk Assessment, none of the material to be excavated poses a significant human health or environmental concern; therefore, consolidation of this material and placement into an engineered landfill provides additional, effective protection. Consolidation also allows the minimization of the land area upon which wastes will remain in place after closure, thus reducing the post-closure escape of constituents of concern. Consolidation also minimizes the need for further maintenance. Uncontaminated areas of the site have generally not been included within the proposed CAMU. Since implementation of the recommended alternative would occur entirely on site, unacceptable risks to humans or the environment will be minimized. Further, designation of the proposed CAMU will allow the flexibility necessary during implementation of the corrective measure, thereby facilitating a more expeditious remedy which, in turn, provides cost effectiveness.

Overall, the proposed CAMU designation would provide RMI the necessary flexibility required for on site management of wastes that have been demonstrated, for the most part, to pose no significant risks or exposure hazards. The proposed CAMU designation is uniquely suited for the RMI Sodium facility due to the similar nature of wastes and the close proximity in which individual SWMU areas are located with respect to each other. There is no need to designate additional SWMUs as part of the CAMU since soil with concentrations above action levels will be removed from Areas B, C, and G, and material can be moved into a CAMU without triggering MTRs or LDRs. Based on these considerations, RMI feels that the information required by 40 CFR 264.552(d) and specified in 40 CFR 264.552(e) has been provided, which will allow the USEPA and the Ohio EPA to designate the proposed CAMU through modification of the existing RCRA permit.

The total present worth of Alternative 4F is estimated at $3,100,000. Total annual O&M costs are estimated at $130,000. A summary and development of these costs are provided in Table 3. RMI will establish a financial mechanism for the Sodium Plant similar to that for other RMI facilities to provide continuous compliance with financial assurance requirements as part of the permit modification for the Sodium Plant. Financial assurance will be provided for an amount at least equal to the cost estimate provided in this supplement.

Implementation of this corrective measures alternative will significantly reduce any risks associated with the existence of site constituents in site media. This alternative consists of removal of waste sources at Areas B, C, and G, and consolidation in an engineered landfill. These corrective measures are expected to result in the continued observation of decreasing constituent concentrations in the site shallow groundwater, thereby reducing the potential for future exposure to groundwater contamination by on site or off site receptors.

SCHEDULE

A proposed schedule was developed and presented in Section 7.0 of the Revised Final CMS for approval and implementation of the final corrective measures. The components of the CMS process remain the same as those identified in the Revised Final CMS (although the dates have changed). The final steps of the process will include USEPA Review and Approval of the Revised Final CMS Report, the CMS Approval, Remedial Design, and Remedial Construction. These steps are further discussed below.

USEPA Review and Approval of Revised Final CMS Report. A typical 30 day Agency review and approval period has been assumed. However, RMI has worked closely with the Agency on this project and, therefore, prefers a shorter review and approval period to expedite implementation of corrective measures.

CMS Approval Process. It is anticipated that approval of the CMS will, essentially, be a three step process. As discussed in proposed 40 CFR sections 264.525(c) and 264.526, the current facility RCRA permit will be revised to indicate the preliminary remedy selection. If promulgated, proposed regulations would require the USEPA to include a Statement of Basis (similar to the Record of Decision under Superfund) in the draft permit modification. As provided under proposed Section 264.526, the draft permit would be issued for a 45 day public review and comment period. Based on public review and comment, an approved final modified RCRA permit would be issued by the USEPA to RMI. These project activities are anticipated to require approximately 16 weeks from approval of the Revised Final CMS.

Remedial Design. To assure that Corrective Measure Construction (CMC) begins in the next construction season, the Corrective Measure Design (CMD) preparation and review process must be scheduled such that the contract for remedial construction is awarded early in a calendar year. This will require the CMD bid and contract documents to be prepared, approved by the Agency, and bid to approved remedial contractors by that date. Considering the relatively straightforward nature of remedial concerns at the RMI site, it is proposed the CMD phase consist of a Preliminary CMD Report and Final CMD for USEPA review and approval. The CMD would not provide design information for the new engineered landfill. That design and construction will be addressed under the Superfund program. The Preliminary CMD Report would include a description of the remedial design components which are required by the final modified permit. No detailed design drawings or specifications would be submitted with the Preliminary CMD Report. Monthly progress reports would be submitted to inform the Agency of progress or any problems encountered during the CMD. The Final CMD would include all detailed plans and specifications and other components (such as the remedy operation and maintenance plan) required by the final modified permit. Preparation of the CMD in this manner will ensure the expeditious implementation and completion of the selected remedy.

Remedial Construction. It is anticipated that CMC would be concurrent with construction of the new engineered landfill and can be successfully completed in approximately nine months. The majority of this time will be necessary for construction of the new engineered landfill. The overall time required for implementation of the remedy and USEPA determination that the conditions of the final modified RCRA permit have been met is anticipated to require up to eighteen months. The schedule for the Fields Brook Superfund remediation will be the controlling factor.

TABLE 1

INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 4E - Excavation of Areas B, C, and G; Disposal at Area A; No Further Action at Areas D and F			
Technically feasible in all evaluation criteria aspects. Erosion, runoff, and constituent migration due to infiltration and percolation significantly reduced. Use of existing on site disposal area improves implementability and maximizes facility land use by eliminating the need to dedicate "new" space for on site placement. Possible existence of utilities (Area G) may decrease implementability of this alternative by causing difficulty in excavation. Operation and maintenance requirements are not significantly greater than existing. No Further Action at Area D reduces potential problems associated with utilities in Area D and reduces volumes handled. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident for this alternative. Erosion, runoff, and constituent migration pathways are eliminated by removal of material. Surface water quality is anticipated to improve almost immediately. Beneficial effects are realized immediately.	Short and long-term direct human exposure pathways are eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Areas A, D, F.
Alternative 4F - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F			
Technically feasible in all evaluation criteria aspects. Erosion, runoff, and constituent migration due to infiltration and percolation virtually eliminated. Use of proposed on-site engineered landfill will provide additional assurance that migration of contaminants will not occur. Possible existence of utilities (Area G) may decrease implementability of this alternative by causing difficulty in excavation. Operation and maintenance requirements are not significantly greater than existing. Implementation of erosion and sediment controls for the stockpile area will make use of the existing brine ponds being used for the landfill construction. No Further Action at Area D reduces potential problems associated with utilities in Area D and reduces volumes handled. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident for this alternative. Erosion, runoff, and constituent migration pathways are eliminated by removal of material. Surface water quality is anticipated to improve almost immediately. Beneficial effects are realized immediately.	Short and long-term direct human exposure pathways are eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration are also eliminated.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Areas A, D, F, and new engineered landfill.
Alternative 4G - Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F; Capping of Area A			
Same as Alternative 4F	Same as Alternative 4F	Same as Alternative 4F	Same as Alternative 4F

TABLE 2

COMPARATIVE SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Comparative Criteria			
Long-Term Reliability and Effectiveness	Reduction of Constituent Mobility, Toxicity, or Volume	Short-Term Effectiveness	Implementability
Alternative 4E - Excavation of Areas B, C, and G; Disposal at Area A; No Further Action at Areas D and F			
Excavation and consolidation of constituent material at Area A is a thorough, effective, and safe response; all maintenance efforts for the useful life of the cap are focused on one area. Consolidation/on-site disposal is an improved land use/management scenario. Excavation of Areas D and F are not necessary to meet the corrective action objectives. Requires land use restrictions at Areas A, D, F.	Potential constituent mobility is reduced substantially because excavated material is consolidated in one area and all other SWMUs targeted for action are eliminated. The risk of constituent mobility at Areas D and F does not warrant corrective action because the constituent source zone is in shallow soil and virtually immobile. Does not address constituent toxicity or volume.	All exposure pathways will be eliminated immediately upon completion of the remedy.	Standard materials, equipment, and construction techniques are applicable, and excavation depths are relatively shallow. Implementability is somewhat complex due to excavation, backfill, and placement requirements. Existing underground utilities may increase implementation difficulty. Implementation time is estimated to take less than six months.
Alternative 4F – Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F			
Excavation and consolidation of constituent material in a new engineered landfill is a more thorough, effective, and safe response compared to Alternative 4E because of the bottom liner, the leachate detection and collection systems, and the gas venting system. Areas D and F are addressed the same as in Alternative 4E.	Not substantially different from Alternative 4E.	Not substantially different from Alternative 4E.	Standard materials, equipment, and construction techniques are applicable, and excavation depths are relatively shallow. Implementability is somewhat complex due to excavation, backfill, and placement requirements. Existing underground utilities may increase implementation difficulty. Implementation time increased over Alternative 4E due to construction time for new engineered landfill.
Alternative 4G – Excavation of Areas B, C, and G; Temporary Stockpiling of Areas B and C Material; On-Site Disposal in a New Engineered Landfill; No Further Action at Areas D and F; Capping of Area A			
Identical to Alternative 4F except slightly greater effectiveness concerning Area A.	Same as 4F	Same as 4F	Same as 4F

TABLE 3

COMPARATIVE COST ANALYSIS

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative	Description	Costs (1993 $) Capital	Annual O & M	Present Worth[a]
4E	Excavation of Areas B, C, and G; Disposal at Area A; No Further Action at D and F Option 1 - Soil Cover System	494,000	19,000	675,000
4F	Excavation of Areas B, C, and G; Stockpile Areas B and C Material; Disposal at Areas B and C; No Further Action at D and F	3,100,000	130,000	4,300,000
4G	Excavation of Areas B, C, and G; Temporary Stockpiling Area B and C Material; On-Site Disposal at Areas B and C; No Further Action at Areas D and F; Geosynthetic Capping of Area A	3,900,000	132,000	5,100,000

[a]Present worth is the result of a 30-year analysis period. All capital costs were assumed to be incurred for year 0 of the analysis, while operation and maintenance costs were assumed for years 1 through 30. A discount rate of 10 percent was assumed for this analysis. Source: *Engineering Economy*; Prentice-Hall, Inc., New Jersey; 5th Edition, 1977.

TABLE 4

SUMMARY OF DECISION CRITERIA FOR PROPOSED CAMU DESIGNATION

RMI SODIUM PLANT
ASHTABULA, OHIO

Decision Criterion[a]	How Recommended Alternative Meets Criterion
Facilitation of Reliable, Effective, Protective, and Cost-Effective Remedy	In general, the recommended alternative includes: excavation of soil from Areas B, C, and G and sediment from the drainage ditch adjacent to Areas B and C, followed by placement in a new engineered landfill. The material to be excavated includes approximately 7,850 cubic yards of wastes, soil, and sediment with low concentrations of inorganics (e.g., arsenic, cadmium, and lead). Additional information on the types and concentrations of the wastes and waste constituents is provided in the approved RFI Report and the Supplemental RFI Report (summarized in Sections 1 and 3 of the Revised Final CMS Report). Excavation and construction of an engineered landfill are proven reliable technologies. The HEA and Baseline Risk Assessment showed that there are no receptors and no significant potential risks; therefore, placing waste material in a landfill will increase protectiveness.
Risks During Remediation	The HEA and the Baseline Risk Assessment have shown that there are no receptors and no significant potential risks associated with this site. The site is located in a sparsely populated, primarily industrial area. Implementation of the recommended alternative will occur entirely on site, within RMI property boundaries. Handling of contaminated material will be minimal and will involve excavation and placement of material in a new landfill (minimal temporary stockpiling of waste material is expected). Short-term concerns identified include dust production, erosion, surface water run-off, and safety issues; all of these will be properly addressed during remedial design and implementation of control measures.
Uncontaminated Areas	The boundaries of the proposed CAMU are shown on Figure 2 and include minimal uncontaminated land. The only temporary stockpile area is for soil from Areas B and C and sediment from a segment of the nearby drainage ditch. The only other areas involved in the corrective measure include existing plant roadways to be used as temporary haul routes. No temporary units or regulated units are included in the proposed CAMU.
Minimizing Future Releases	By consolidating waste materials on site and placing the waste material in an engineered landfill, the potential for future releases has been significantly reduced.

TABLE 4 (Continued)

SUMMARY OF DECISION CRITERIA FOR PROPOSED CAMU DESIGNATION

RMI SODIUM PLANT
ASHTABULA, OHIO

Decision Criterion[a]	How Recommended Alternative Meets Criterion
Timing	No innovative technologies are included in the recommended alternative; however, designation of a CAMU will result in no minimum technology requirements becoming effective. This will allow construction of an engineered landfill that has been shown to be adequately protective. This will, in turn, substantially decrease the time required to complete implementation of the corrective measures. A proposed schedule for implementation of the recommended alternative is included in this supplement.
Enhancing Long-Term Effectiveness	Waste materials will not be treated as part of the recommended alternative. Treatment technologies suitable for the type of constituents present at the site (low concentration inorganics) would minimally reduce mobility, but increase volume. Placement of waste materials in an engineered landfill will also reduce mobility without increasing volume. Existing groundwater monitoring data in the vicinity of Area A have shown no degradation of the shallow water-bearing zone. Continued monitoring of the shallow water-bearing zone will consist of semiannual monitoring of existing and new proposed wells in the vicinity of Area A. Monitoring of the unsaturated zone or of run-on and run-off will not be necessary. Additional post-closure maintenance will include inspection and repair of the soil cover for Area A and the new landfill, in addition to site maintenance activities.
Minimizing Land Areas Where Wastes Will Remain in Place	In this CAMU approach, soil from Areas B, C, and G will be consolidated in a new landfill. The waste material to be excavated includes soil with some of the higher concentrations of constituents of interest. The soil that will remain in place has been shown to present minimal potential risk and, in fact, risk estimates approach those of background conditions.

[a]As provided in 40 CFR 264.552(c).

FIGURE 1
LOCATIONS OF RCRA SWMU's AND THE NEW ENGINEERED LANDFILL FOR FIELDS BROOK MATERIALS

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

RMI SODIUM PLANT
Ashtabula, Ohio

FIGURE 2
LAYOUT OF RECOMMENDED CORRECTIVE MEASURE ALTERNATIVE (4F) AND LIMITS OF PROPOSED CORRECTIVE ACTION MANAGEMENT UNIT

SCALE: 1" = 100'			
DRAWN BY	DATE 12/98	CHECKED BY	APPROVED BY
DRAWING NUMBER			

RECEIVED
MAR 11 1993
RCRA PERMITTING BRANCH
OR/WMD
EPA, REGION V

CORRECTIVE MEASURES STUDY PLAN
RMI SODIUM PLANT
ASHTABULA, OHIO

Prepared for:

RMI TITANIUM COMPANY
Niles, Ohio

Prepared by:

ECKENFELDER INC.
227 French Landing Drive
Nashville, Tennessee 37228
(615) 255-2288

May 1991
(Revised August 1991)
(Revised March 1993)

6497

Q:\6497\WPCVR.DOC

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Corrective Measures Study (CMS) Plan is to tailor a corrective measures study to the complexity and scope of the remedial situation at the RMI facility. As determined by the RCRA Facility Investigation (RFI) and the Health and Environmental Assessment (HEA) and as further discussed in this CMS Plan, soils containing constituents of interest above established action levels in various site areas are the primary environmental media concern at the RMI site. In addition, remediation of sediments affected by Solid Waste Management Units will also be evaluated. There is also concern regarding future potential impacts to groundwater. Therefore, remedies will also be evaluated in terms of reduction in potential sources of groundwater contamination. As such, this CMS Plan describes the relatively straightforward manner in which a sound, environmentally protective remedy for this site will be developed.

The manner in which appropriate remedies are to be identified and evaluated have generally been established by the "Scope of Work for a Corrective Measures Study at RMI - Sodium Plant" (included as Appendix A), previously issued by the USEPA. In the following sections, the manner in which this Scope of Work will be performed for the RMI - Sodium Plant (RMI) CMS is described.

1.2 BACKGROUND

In early 1987, the RMI Company Sodium Plant (RMI) received a final Resource Conservation and Recovery Act (RCRA) hazardous waste management operating permit from the USEPA Region V. In the RCRA permit, RMI was required by USEPA to prepare a Work Plan for, and to conduct, a RCRA Facility Investigation (RFI). The RFI Work Plan was submitted to the Agencies in June 1987. In late March 1988, USEPA approved the Work Plan.

The RFI report was submitted to the USEPA in May 1989. The USEPA prepared formal comments on the RFI report and transmitted these comments to Mr. Richard Mason of RMI in a letter dated April 4, 1990 from Mr. Karl E. Bremer, Chief of the USEPA Region V RCRA Permitting Branch. On May 9, 1990, a meeting was held in

USEPA's RCRA branch office to discuss the USEPA's comments on the RFI. Representatives from the USEPA, Metcalf & Eddy (USEPA's consultant), RMI, and ECKENFELDER INC. attended the meeting.

It was also agreed during this meeting (and subsequently confirmed by a letter from the USEPA to the Company dated May 18, 1990) that a formal response to USEPA's comments would be submitted to the USEPA by RMI on June 12, 1990 and would include a discussion of additional work proposed for the site. In addition, it was determined that Task IA of the CMS Scope of Work given in USEPA's April 4, 1990 comments and a plan for completing Task IB would be prepared and submitted to the USEPA by June 29, 1990. As discussed during the May 9, 1990 meeting, the revised Health and Environmental Assessment (HEA, previously Section 7.0 of the RFI report) would be revised and included in the June 29 submittal as part of the CMS Tasks, and would be removed from the RFI report. Sections 1 through 6 of the RFI report were revised per USEPA's comments and discussions from the May 9, 1990 meeting, and submitted to the USEPA on June 29, 1990 as the Revised RFI report.

As agreed during the May 9, 1990 meeting, RMI submitted a document on June 12, 1990 containing the formal responses to the USEPA comments on the RFI and descriptions of additional work to be performed at the site. As also agreed upon during the May 9, 1990 meeting, RMI provided a partial submittal of the draft CMS report on June 29, 1990. This included the execution of Task IA, the revised Health and Environmental Assessment (HEA), and the plan for executing Task IB, as agreed.

A Supplemental Work Plan (ECKENFELDER INC., October 1990) was prepared for the conduct of additional site work requested in the May 9, 1990 meeting by the USEPA. This plan was submitted to the USEPA in October 1990 and was subsequently revised in response to comments issued by the USEPA on December 11, 1990. The revised Supplemental Work Plan was submitted to the USEPA in January 1991 and was approved by the USEPA on February 19, 1991. The supplemental investigation was subsequently conducted and a report of that investigation was submitted to the USEPA on April 30, 1991.

A draft Corrective Measures Study Plan was prepared by ECKENFELDER INC. and submitted to the USEPA in May 1991. Comments were issued by the USEPA in July 1991. These comments and the subsequent responses are contained in Appendix B and have been incorporated into the following revised Corrective Measures Study Plan.

1.3 FINDINGS AND CONCLUSIONS OF PREVIOUS STUDIES

1.3.1 RCRA Facility Investigation Report

Site geologic conditions were determined to correlate quite well with regional reports. Groundwater was observed to occur within two zones beneath the RMI site:

- An unconfined water table zone within the fill and upper glacial till with moderate hydraulic conductivity and within the deeper unweathered glacial till with presumed lower hydraulic conductivity. In general, the groundwater is mounded around the ponds at the site and the overall groundwater flow directions radiate outward from the site; and

- A confined water-bearing zone within the lower hydraulic conductivity shale. Based upon limited piezometric surface data and, consistent with the geologic literature, the horizontal flow of groundwater in the shale is toward the north to Lake Erie.

In the RFI report it was demonstrated that the uppermost water-bearing zone (or that in the glacial till) in the vicinity of the RMI Sodium Plant is characterized by low yield and, therefore, groundwater in this water bearing zone is not expected to serve as a drinking water source. (Later, this was supported by the HEA where it was noted that there is an absence of human receptors of shallow groundwater and there is an abundance of surface water for use as a drinking water source.)

On site surface water drainage patterns indicate that a runoff divide exists within the main process area of the plant site. Water falling south of the divide will generally be intercepted by ditches which flow to the west and south, discharging into the DS Tributary of Fields Brook. Water falling north of the divide will flow off site to the north and, presumably, ultimately into Lake Erie.

Constituents present in the environmental media on the RMI site are interrelated through a variety of potential release mechanisms and migration pathways. The findings and explanations for the presence of site constituents in the media sampled at the RMI site are briefly described in the following paragraphs.

Air. No measurements of total organic vapors and gases in ambient air above background levels were observed during field activities, with the exception of observed HNU readings in the vicinity of the borehole during drilling of PZ-9 (at 19 feet) and PZ-8 (at 10 feet), and in the soil headspace HNU readings of soils collected from borings 1S and 2S. These borings are all located in the vicinity of the southern property boundary where a dense non-aqueous phase liquid (DNAPL) originating off the site was detected. The detection of the DNAPL is further discussed in this section under **Off-Site Source(s)**. Although no air monitoring has been conducted for metals, it is possible that trace quantities of metals sorbed onto the surficial soils may migrate via fugitive dust.

Groundwater. Elevated concentrations (with respect to background conditions as determined by monitoring wells 9-S and 10-S) of Ba and Cd in shallow groundwater have been detected on site, particularly in the areas north (Area G) and east of the wastewater treatment ponds (Area D). The highest concentration of Ba detected in groundwater was 1,900 ppb, in well 8-S near Area G; the highest concentration of Cd was 25.7 ppb, in well 6-S near Area D. Levels of barium above action levels set by USEPA were also detected in well 3S (1200 ppb), and levels of cadmium above action levels were detected in well 4S (14.3 ppb). These wells are located east and north of the landfill area. The presence of these constituents in groundwater is believed to be due, in part, to recharge of the groundwater from the wastewater treatment ponds, and possibly from the leaching of subsurface soils or buried wastes.

More recent sampling of these monitoring wells where action levels were previously exceeded indicates a significant reduction in constituent levels. Barium, previously detected in well 8S at 1,900 ppb, has since been detected at 830 ppb. Cadmium, previously detected in wells 4S (14.3 ppb) and 6S (25.7 ppb), has since been found at 1.9 ppb and 7.7 ppb, respectively, in these wells. In addition, the USEPA has recently promulgated new drinking water MCLs (the original basis for action levels) for barium and cadmium at 2,000 ppb and 5 ppb, respectively. In comparison, all of the sample results for barium are below the promulgated MCL for barium and all of the most recent sample results for cadmium are below or near the promulgated MCL for cadmium.

The direction of contaminant migration in shallow groundwater appears to radiate outward from the site. The shallow groundwater ultimately discharges to the DS tributary of Fields Brook in the vicinity of the closed landfill, and to the drainage ditch east of the five ponds. However, because the drainage ditches are shallow and do not intercept the entire water table zone, contributions of constituents from shallow groundwater to surface water ditches are expected to be minimal. The rate of Ba and Cd migration in the shallow groundwater is believed to be primarily controlled by the high sorption potential of the barium and cadmium ions.

The concentrations of metals measured in the shale groundwater zone are at background levels as determined by data from background monitoring well 11-D. Barium was the only metal consistently detected in the bedrock groundwater wells and it occurred at concentrations greater than the shallow groundwater background values. However, the presence of Ba in the deep bedrock groundwater does not necessarily indicate a connection with the SWMUs on site. Based upon the low permeability and considerable thickness of the unweathered glacial till, and the relatively small hydraulic gradient between the bedrock and the shallow aquifer, it is apparent that only a minimal downward component of flow exists between the two water bearing zones. In addition, major ion data demonstrate that the bedrock groundwater has a distinctively different chemistry than the shallow groundwater. Barium/chloride ratios in the deep and shallow aquifers are also inconsistent with the hypothesis that the deep groundwater had been impacted by the shallow groundwater. Barium in the deep groundwater occurs at higher concentrations than shallow groundwater, while chloride concentrations in the deep groundwaters are much lower than in shallow groundwater. (It is noted that the ratios for wells 9S and 9D do not follow this pattern. The chloride concentration in well 9S (70 ppm) is much less than that in 9D (11,900 ppm) due to the localized influence of the Ashco water supply reservoir.) These inverted ratios indicate that the barium in the deep groundwater is naturally occurring. Therefore, water quality in the bedrock groundwater is not affected by he SWMUs on site.

Soils. Both surficial and subsurface soils were collected at various locations on the RMI plant site. Surficial soil samples were analyzed for nine inorganic parameters. A statistical test (Student's t test) was applied to the surficial soil data to assess the significance of the differences in means found between samples from background and test areas. Compared to background concentrations, Ba, Cd, Pb, nickel (Ni) and arsenic (As) in Area B; Ba, As, Pb, and selenium (Se) in Area C; Ba; Cd, Pb, Ni, and As in Area F; and Ba, Cd, chromium (Cr), Ni, and As in Area G were determined to be present in surficial soils at elevated concentrations. A priority pollutant scan was also conducted on one sample. No volatile organic, acid extractable, or base neutral compounds, pesticides, PCBs, phenols, or cyanide were detected.

Subsurface soil samples were analyzed for nine inorganic parameters as well as total cyanide. The subsurface soils which showed elevated concentrations were determined to be: Area D, between 3.0 and 6.5 feet for Ba, Pb, and Ni; and Area G for Pb, Cd, and Ni at depths less than 6.5 feet. When comparing subsurface soil data with surficial soil data, it is apparent that the SWMUs in the vicinity of the ponds (Areas D, F and G) were used as fill areas and the SWMUs in the vicinity of the closed landfill. (Areas B and C) were used as temporary surficial storage zones for material that was later placed into the landfill. Priority pollutant scans were conducted on three samples. Volatile organic, base neutral, and acid extractable compound were detected only in the vicinity of the DNAPL, which originates from an off site source (further discussed below). Two samples exceeded the EP Toxicity Equivalent for lead and cadmium (the respective MCL multiplied by 20, which was used to screen samples for EP toxicity testing). However, when EP Toxicity tests were performed on these samples, it was determined that they were not EP Toxic for cadmium or lead.

Surface Water. Samples were collected from the wastewater treatment ponds, the french drain system, and the site drainage ditches. Barium Ba and Cd were found in all of the ponds, with Ba in the highest concentrations in both the pond water (at 5,500 ppb in Pond 3) and pond sediments (3,020 ppm in Pond 4). Barium appeared to be the only parameter detected in the pond sediments at elevated concentrations. The concentration of barium in the french drain samples was lower than the pond water samples, and the concentration of cadmium in the french drain samples was similar to the pond water samples, with the exception of one cadmium sample which was substantially higher in the french drain sample (26.8 ppb in MHW-5). Very low concentration were found for most constituents in the ditch samples; the highest levels detected were: zinc (Zn) at 359 ppb at DW-E (and at 77 ppb at DW-G) and Cd, at 37.9 ppb at location DW-B. Because of the location of DW-E (of the southeast corner of the property, where the ditch originates from off site), it is believed that the Zn could be attributed to an off site source to the east. The concentration of Cd at location DW-B is believed to be the result of the presence of suspended sediment in the water sample which likely originated from the erosion of surficial soils from Area B. Although the presence of the organics was indicated from the results of priority pollutant scans (conducted on samples DW-E and DW-G), the presence of organics is believed to be due to sources originating off site.

Off Site Source(s). A dense non-aqueous phase liquid (DNAPL) comprised of chlorinated solvents and associated dissolved constituents found on the RMI site is believed to be the result of an off site source located to the south. This conclusion is based on the fact that RMI does not and has never used chlorinated solvents at the Sodium Plant. This is supported by the observation that the major portion of the sandy till zone which contains the DNAPL occurs to the south of the RMI site, and the piezometric surface of the DNAPL-saturated sandy till has not been observed anywhere except the extreme southern boundary of the RMI site. In addition, dissolved organic constituents from the DNAPL have only been observed in the immediate vicinity of the southern boundary of the RMI property. A chemical manufacturing facility, located on the southern border of the site, has historically discharged chlorinated solvents to Fields Brook and unlined settling lagoons on their property. Therefore, sufficient information has been collected to conclude that the DNAPL source is off site to the south.

1.3.2 Revised Health and Environmental Assessment

Constituents present in the environmental media on the RMI site are interrelated through a variety of potential release mechanisms and migration pathways. The findings and explanation for the presence of site constituents in the media sampled at the RMI site, as well as the significance of these concentrations with regard to potential receptors, are briefly described in the following paragraphs.

Groundwater

Elevated concentrations of Ba and Cd in shallow groundwater have been detected on site, particularly in the areas north (Area G) and east of the wastewater treatment ponds (Area D). The highest concentration of Ba detected in groundwater was 1,900 ppb, in well 8-S near Areas G; the highest concentration of Cd was 25.7 ppb, in monitoring well 6-S near Area D. Levels of barium above action levels set by USEPA were also detected in well 3S (1200 ppb), and levels of cadmium above action levels were detected in well 4S (14.3 ppb). These wells are located east and north of the landfill area. The presence of these constituents in groundwater is believed to be due, in part, to recharge of the groundwater from the wastewater treatment ponds and possibly from the leaching of subsurface soils or buried wastes.

More recent sampling of these monitoring wells where action levels were previously exceeded indicates a significant reduction in constituent levels. Barium, previously detected in well 8S at 1,900 ppb, has since been detected at 830 ppb. Cadmium, previously detected in wells 4S (14.3 ppb) and 6S (25.7 ppb), has since been found at 1.9 ppb and 7.7 ppb, respectively, in these wells. In addition, the USEPA has recently promulgated new drinking water MCLs (the original basis for action levels) for barium and cadmium at 2,000 ppb and 5 ppb, respectively. In comparison, all of the sample results for barium are below the promulgated MCL for barium and all of the most recent sample results for cadmium are below or near the promulgated MCL for cadmium.

The only potential groundwater migration pathways identified were: discharge of shallow groundwater to deep groundwater; and discharge to on site surface water ditches. Discharge to deeper groundwater is considered to be unlikely due to the low hydraulic conductivity and thickness of the unweathered glacial till zone and a minimal downward component of groundwater flow. Discharge of shallow groundwater to site drainage ditches was determined to be a possible migration pathway. However, because the drainage ditches are shallow and do not intercept the entire water table zone, contributions of constituents from groundwater to on site surface water ditches are expected to be minimal. In addition, because of the low hydraulic conductivity of the water table zone and the predicted attenuation of site constituents based on site soil properties and the physical/chemical properties of the constituents, site constituents are expected to migrate off site at a slow rate.

Retardation factors calculated for the site constituents indicated that the constituents are being effectively attenuated in subsurface soils, and are moving much more slowly than the mass flow of groundwater.

In the RFI report it was demonstrated that the uppermost water-bearing zone (or that in the glacial till) in the vicinity of the RMI Sodium Plant is characterized by low yield. In addition, no receptors of shallow groundwater in the vicinity of the RMI plant were identified, because the majority of the local population relies on surface water for drinking water supplies. Thus, the uppermost formation is not expected to serve as a source of drinking water. Because there were no receptors, comparisons with exposure criteria were not performed. Therefore, no exposure to site constituents via the groundwater pathway was predicted.

Soil

Both surficial and subsurface soils were collected at various locations around the RMI plant site. Compared to background concentrations, Ba, Cd, Pb, Ni and As in Areas B and C (combined); Ba, Pb, Ni, and As in Area F; and Ba, Cd, Ni, and As in Area G were determined to be present in surficial soils at elevated concentrations. Areas B and C combined had the highest average surficial soil concentration for all site constituents except Cr and Se. The subsurface soils in elevated concentrations were determined to be: Area D, up to between 6.5 and 13.3 feet for Ba, Pb, and Ni; and Area G for a variety of constituents at several different depths. The highest overall subsurface soil concentrations were found in Area G, for all constituents except As and Se. The presence of these constituents in these areas was consistent with what was known about the placement of wastes in the Areas D and G. The concentrations of constituents in surficial soils generally appeared to be greatly attenuated with depth. However, in Area G, no "gradient" of waste constituents was observed which indicated that the distribution concentration of constituents with depth was representative of the placement of wastes over time, rather than the downward leaching of constituents. Arsenic was found in remarkably consistent concentrations in surficial and subsurface soils collected throughout the site. The range of average concentrations of As in soils from less than one foot in depth to 58 feet in depth was 16.4 to 22.8 ppm. Although concentrations of As in soils were found to be consistent, levels of As in surficial soils from Areas B, C, F, and G were found at concentrations which were statistically significant (greater) as compared to background concentrations. It is thought that the levels of As found were either natural to the regional area, or were the result of agricultural use of arsenic-containing pesticides on the soil before soil fill was imported to the site.

The most likely and significant soil migration pathway was determined to be the erosion of surficial soils to on site surface water ditches. Predicted erosion losses via precipitation from the waste management areas were quantified by use of the Universal Soil Loss Equation (USLE). On a per unit basis, Area F had the highest estimated overall soil losses, with Ba as the highest constituent lost, at a rate of 2.19 lb/yr. On a per acre basis, however, Area B was predicated to have the highest overall losses, again with Ba as the highest rate of loss, at 5.43 lb/yr. Other potential migration pathways were considered possible, such as the leaching of surficial soils to shallow groundwater and/or to surface water; and the leaching of subsurface soils to shallow groundwater. However, these pathways are not expected to be significant because of the likelihood of a high degree of sorption of the site constituents to site soils, based on the chemical and physical properties of the constituents and of the soils e.g., K_d values, CEC, organic content). As discussed in Sections 2.2.2.1 and 2.2.2.2 of the CMS report (Partial Submittal), EP toxicity tests performed on subsurface soils with the highest concentrations of Cd an Pb indicated that leaching of subsurface soils is not likely to occur to a significant degree. Cd was predicted to be one of the most mobile of the site constituents.

Because access to the site is restricted and there were no receptors identified in the immediate vicinity of the RMI plant, comparison to exposure criteria was not considered appropriate. Instead, the predicted erosion losses were compared to the proposed municipal sewage sludge disposal loading rates for the site constituents. All predicated erosion rates were far below federally proposed sewage sludge disposal loading rates. Using the most conservative values of erosion loss, it appeared that none of the constituent concentrations in surficial soils in any waste management areas were at potential levels of concern, with regard to erosion. However, as stated in their September 24, 1991 comments on the RMI Sodium Plant revised CMS Plan, the USEPA notes that this comparison does not have any regulatory significance for RCRA corrective action decisions.

Surface Water

Samples were collected from the wastewater treatment ponds, the french drain system, and the on site drainage ditches during the RFI. Barium and Cd were found in all of the ponds, with Ba in the highest concentrations in both pond water (at 5,500 ppb in Pond 3) and pond sediments (3,020 ppm in Pond 4). The concentration of barium in the french drain samples was lower than the pond water samples, and the concentration of cadmium in the french drain samples was similar to the pond water samples, with the exception of one cadmium sample which was substantially higher in the french drain sample (26.8 ppb in MHW-5). Very low concentrations were found for most constituents in the on site ditch water samples; the highest levels detected were: Zn at 359 ppb at DW-E (and at 77 ppb at DW-G) and Cd, at 37.9 ppb at location DW-B. Because of the location of DW-E (of the southeast corner of the property, where the ditch originates from off site), it was speculated that the Zn could be attributed to an off site source to the east. The relatively high concentration of Cd at location DW-B is believed to most likely be the result of elevated concentrations of eroded surficial soils originating from Area B.

There were several potential release mechanisms identified which may explain the presence of site constituents in the on site drainage ditches, including erosion of surficial soils; discharge of shallow groundwater to ditches; and possibly leaching of surficial soils and subsequent transport to ditches via runoff. However, as discussed previously, only the potential erosion of surficial soils to the on site ditches was determined to be of significance. Calculations of theoretical maximum concentrations expected in water based on solubilities of the constituents indicated that sorption of the constituents was likely to be rather significant, and would limit the expected concentrations of constituents in on site ditch water. The only exception was Cd, which was predicted at lower concentrations than actually measured (at DW-B). This may have been due to the presence of suspended particulates in the water sample.

In comparing the concentrations of the principal waste constituents (Ba, Cd, and Pb) measured in on site ditch water samples with nearby surficial soil concentrations, it was shown that Ba appeared to be strongly sorbed, as it was present in relatively high concentrations in soil, but was never detected in the water samples collected.

Cadmium was usually detected in water at low concentrations when it was present in soil; and the behavior of Pb was inconclusive.

No human receptors of surface water potentially migrating off site via the DS Tributary were identified, and the only likely environmental receptors were determined to be extremely tolerant lower aquatic species possibly present in downstream Fields Brook. The DS Tributary was not believed to be capable of supporting fish or higher forms of aquatic species. The concentrations of constituents in water from location DW-G (considered to be representative of what may be migrating off site) were compared to the Ohio Water Quality Standards and to federal AWQC. The concentrations in DW-G were found to be below all criteria for all constituents, except the Ohio Warm Water Habitat Standard for Cd (1.9 ppb). This was not determined to be significant, as it is highly unlikely that the DS Tributary would meet the requirements of a warm water habitat. However, the USEPA has determined that a surface water action level has been exceeded for sampling location DW-B for cadmium, applying the use designation for the Fields Brook tributary to the on-site tributary. In addition, in September 1990 USEPA representatives observed frogs in the DS tributary on site. Therefore, higher aquatic species are present periodically in this tributary.

Air

No sources or potential release mechanisms were considered relevant to the air pathway because of the lack of on-site receptors, with the possible exception of RMI workers. However, potential exposures to site workers are regulated by OSHA, and are not relevant to the RFI or CMS process. Although no air monitoring data are available for metals, it is possible that trace quantities of metal which may be sorbed to surficial soil may migrate via fugitive dust.

1.3.3 Supplemental Site Investigation for the RFI

The Supplemental Site Investigation for the RFI concluded the following:

- The bedrock groundwater piezometric surface is mounded near the eastern boundary of the Sodium Plant site in response to the potentiometric head generated by the large volume of water potentially contained within an off-site coal pile. The overall direction of bedrock groundwater flow is to the north towards Lake Erie and is locally influenced by the coal pile. Recent observations indicate that there is a net upward vertical gradient between the bedrock and shallow groundwater in the vicinity of the wastewater treatment ponds.

- The shallow drainage ditch off site and parallel to the eastern RMI property boundary flows both to the north and south with the flow divide located in the vicinity of stream gage SG-18, and recharges the shallow groundwater. A potential source of this water is broken water piping from the Ashco (water supply) Reservoir.

- The shallow groundwater is mounded around the five wastewater treatment ponds and is recharged to the east by the drainage ditch nearest to the site. Due to the large storage capacity of water within the coal pile, the groundwater level is probably quite elevated within the coal pile. The shallow ditch nearest to the site appears to act to some degree as a groundwater divide between RMI property and the coal pile.

- The barium concentrations in the bedrock groundwater measured during the supplemental sampling are similar to those in the original RFI with the exception of groundwater from well 9-D. The barium concentration in well 9-D was greater than three times higher than has been measured during the previous sampling episodes and this may be related to matrix interferences or variability inherent in the analytical methodology.

- Literature on barium concentrations in the Chagrin Shale provide information that supports the conclusion that barium in the bedrock underlying the RMI site is likely to be naturally occurring.

- Cadmium concentrations in the shallow groundwater have decreased considerably across the site since the previous samples were collected during the original RFI investigation and the migration of cadmium off site is unlikely. Since RMI has implemented process changes eliminating the use of cadmium in the manufacturing process over 2.5 years ago, there is no reason to believe that the recently observed trend of decreasing cadmium levels in shallow groundwater monitoring wells will not continue.

- Elevated levels of cadmium, chromium, nickel, and zinc were detected in off site well 12-S. These inorganics were documented to be constituents of coal, and studies have shown that nickel and zinc, and to a lesser degree cadmium and chromium, result from runoff or leaching from coal piles. The drainage ditch adjacent to the eastern RMI property boundary acts as a groundwater divide between the groundwater impacted by the coal pile and RMI property. Therefore, the elevated levels of metals detected in off site well 12-S are apparently components of the low pH groundwater generated by the off site coal pile, and not the result of migration of constituents from the RMI Sodium Plant property.

- The inorganics found in the off-site ditch water in detectable concentrations are at relatively low levels.

- The inorganics found in the off-site ditch sediments are at concentrations similar to those detected in the on-site ditch sediments, with the exception of significantly lower barium concentrations. The sediment inorganic concentrations combined with low levels of inorganics in the surface water indicate that inorganics are strongly sorbed onto the sediments.

- The barium and cadmium detected in the on-site ditch sediments most likely reflect the result of erosion of surficial soils in the adjacent disposal area (Area B).

- A comparison to the action levels proposed by the USEPA indicated the following:

  - None of the proposed groundwater action levels were considered relevant because RMI has demonstrated that the shallow water bearing zone is characterized by a low yield and because of the absence of human receptors in the vicinity of the RMI Sodium Plant. For these reasons and due to the abundant surface water supply, it is not expected that the shallow water bearing formation would be used as a drinking water source. In addition, it was determined that it is not likely that deep bedrock groundwater has been affected by Sodium Plant activities.

- The action level for cadmium in surface water was not exceeded by the surface water samples collected from the off site ditch during the Supplemental RFI sampling.

2.0 DEVELOPMENT OF THE CMS

2.1 GENERAL APPROACH

The general approach to performing this corrective measures study will be to follow the guidelines presented in the "Scope of Work for a Corrective Measures Study at RMI-Sodium Plant" (Scope of Work). As previously stated, however, this CMS Plan has been prepared such that the CMS will be focused on the site areas and media of interest previously identified by the RFI, the revised HEA, and the Supplemental Investigation to the RFI. In the following sections, specific site areas and appropriate corrective measure technologies to be evaluated by the CMS are presented. As well, the manner in which the corrective measure alternatives will be evaluated is outlined. Other requirements of the Scope of Work, including the CMS Report format and CMS scheduling, will be addressed as indicated.

2.2 CMS OBJECTIVES

2.2.1 Overall Objectives

The overall objective of the CMS is to utilize the findings and conclusions of the RFI, the supplemental investigation for the RFI, and the HEA for the identification and development of appropriate corrective measures deemed adequate to protect human health and the environment.

In addition, corrective action measures will address the following general objectives.

- Attain media cleanup goals, as appropriate (to be developed as part of the CMS process).

- Control the sources of releases to reduce or eliminate, to the maximum extent practicable, further releases that may pose a threat to human health and the environment.

- Comply with applicable standards for the management of wastes.

2.2.2 Corrective Action Objectives

By comparing concentrations of site constituents in various site media to Agency-proposed "action levels", it has been determined which areas (SWMUs), media and constituents must be addressed by the CMS. This comparison was performed in the partial submittal of the draft CMS Report submittal to the USEPA on June 29, 1990. The results of the evaluation are presented below.

2.2.2.1 Groundwater. An action level for barium in selected shallow and deep wells was proposed by the USEPA, and an action level for cadmium in selected shallow wells was proposed by the USEPA. In addition, action levels for organic constituents were proposed for selected shallow wells.

Action levels for organics are not appropriate as it has been demonstrated that the organics at the RMI Sodium Plant originate from off site. A comparison of action levels to concentrations of constituents in deep wells is not considered appropriate because it has been demonstrated that it is not likely that the deeper water-bearing zone is being affected by Sodium Plant activities.

The RFI demonstrated an insufficient yield for domestic use of the shallow water-bearing zone and the HEA demonstrated the absence of potential receptors via the groundwater pathway. In addition, it was determined that it is not likely that deep bedrock groundwater has been affected by Sodium Plant activities. For these reasons and due to the abundant surface water supply, it is not expected that the shallow water-bearing zone would be used as a drinking water source. Therefore, proposed groundwater action levels will be addressed by establishing appropriate corrective action objectives for waste sources.

2.2.2.2 Shallow/Near Subsurface Soils. Action levels were proposed for inorganics in shallow soils by the USEPA for the following SWMUs and constituents: cadmium: Areas B and G; lead: Areas B, C, D, F, and G; arsenic: Areas B, C, G, and F. Action levels were also proposed for some organic constituents in shallow soils.

As previously discussed, action levels for organics are not appropriate, as it has been demonstrated that the organics at the Sodium Plant site originate from off site.

The proposed action levels for inorganics in shallow soils have been accepted given that it is understood that the action levels merely serve to identify that these areas and constituents which will be further addressed in the development of the CMS.

2.2.2.3 Surface Water. One action level was proposed by the USEPA: for cadmium at location DW-B. Although RMI does not consider the use designations for the Fields Brook Tributary appropriate to apply to the on site drainage ditch system, this action level is accepted since it is understood that the action level only serves to identify this area (near DW-B) and constituent as needing to be further addressed in the CMS report.

2.2.2.4 Deep Soils. No action levels for deep soils were proposed by the USEPA; however, it was noted in the May 24, 1990 letter to RMI that deep soils should be evaluated in terms of their potential to transfer constituents to groundwater. The letter also noted that such an evaluation should employ measured K_d values instead of literature values.

As stated in Section 2.2.2 of the RFI, the predictions of constituent mobility made on the basis of literature K_d values (and other factors relevant to the discussion) have been substantiated by site measurements of constituents in groundwater, soils, and surface water. In particular, the EP Toxicity test for cadmium and lead was applied to subsurface soil samples having the highest measured values of barium, cadmium, and lead in subsoils collected from the site. These results of the tests indicated that neither cadmium or lead is likely to leach from the subsoils (barium was not measured), i.e., the EP Toxicity Limits were not exceeded for any sample. In addition, the test results indicate that neither cadmium nor lead are likely to leach and cause subsurface soils to be classified as hazardous waste. Based on the previously presented evaluation and data, the potential for constituent migration from deep soils will be considered during the CMS. The following USEPA guidance document will be utilized as appropriate: EPA 540/2-89/057, *Determining Soil Response Action Levels Based on Potential Migration to Groundwater*, USEPA, OERR, October 1989. Also, as discussed above, groundwater action levels are not appropriate for this site. Based on the previously presented evaluation and data, it is therefore considered unnecessary to further evaluate the potential for deep soils to act as a source for groundwater contamination. No corrective action measures specific to the remediation of deep soils will be included in the CMS.

2.2.2.5 Summary of Areas to be Addressed in the CMS. Based on the evaluation of the Agency-proposed action levels, the following areas were identified for evaluation during CMS, for the listed constituents:

Area B: Cd, Pb, and As in surficial soils; Cd in surface water in drainage ditch near Area B (DW-B)

Area C: Pb and As in surficial soils

Area D: Pb in shallow soils 3 to 6.5 feet deep

Area F: Pb and As in surficial soils

Area G: As and Pb in surficial soils; Cd and Pb in soils 0.5 to 3.3 feet deep

The summary of the site areas, media and constituents of interest are listed in Table 2-1 along with a preliminary estimate of the extent to which corrective measures may potentially be applied. In addition, areas where groundwater samples exceeded the action levels will be discussed in the CMS: Well 3-S, Well 6-S, and Well 8-S for barium; Well 4-S, Well 6-S, and Well 8-S for cadmium. Table 2-2 presents analytical data for monitoring wells near site areas and USEPA action levels for groundwater constituents.

2.2.2.6 Preliminary Corrective Action Objectives. Based on an evaluation of action levels and site area/media to be addressed by the CMS, the following preliminary site corrective action objectives have been established. These corrective action objectives will be applied to the various site areas listed above to be addressed by the CMS. This will result in the determination of area specific corrective action objectives for which potential corrective measure technologies will be identified and evaluated.

- Reduce the potential for transport of constituents present in sediment and water in drainage areas.